REMARKS/ARGUMENTS

In the Office action dated November 10, 2004, the Examiner objected to the Abstract of the Disclosure as being written in legal claim language. The Examiner stated that if claim 3 were allowed, claim 8 would be rejected as being a substantial duplicate of claim 3. The Examiner rejected claims 1-12 under 35 U.S.C. § 103(a) as being unpatentable over U. S. Patent No. 6,172,769 B1 to Rao *et al.* in view of U. S. Patent No. 5,777,757 to Karlsson *et al.*

In the Specification, no changes.

In the Claims, claims 1 and 8 are amended.

Initially addressing the Examiner's objection to the Abstract, Applicant is not able to find any "legal claim language" in the Abstract, although the Abstract of the Disclosure is a restatement of the broadest claim. If the Examiner can cite specific language, rather than the blanket assertion using canned MPEP language, Applicant will consider the objection; otherwise, Applicant believes the Abstract to be presented in acceptable language, and contends that the objection should be withdrawn.

The Invention

The provides a method of screening, in color reproduction systems, to render second generation halftone images through a multi-level halftone technique. It is difficult to render halftone images using a second halftone process, because two halftones interfere, causing a distortion, in the form of a low frequency binary banding pattern, called moiré, which appears as alternating light and dark bands, or patches, in the second generation halftone image.

The normal procedure to reduce or eliminate this moiré is by applying a low pass filter to the original halftone image, thus smoothing or eliminating the binary pattern. Such low

pass filters may be optical or digital, and smooth or eliminate the original halftone pattern, which is essentially an averaging process over the entire halftone pattern. The filtering process causes blurred edges and loss of fine details. This additional digital image process considerably slows the rendering process. Some improvements to the filtering process attempt to preserve sharp edges, however, these improvements only help to preserve hard, distinct edges and do nothing to preserve fine details.

The method of the invention uses a multi-level screening process to preserve the original halftone structure, without introducing distortion, or moiré, into a resultant, second generation halftone image. The method of the invention does not destroy or blur the halftone pattern: it preserves the original halftone dots by using multi-level tone reproduction. This method renders the original halftone image without introducing any interference pattern, or moiré, from the second screen pattern, which normally interferes with the original screen pattern.
In the method of the invention, multi-level halftoning provides a "soft screening", that *averages the scanning noises* without reconstructing new halftone centers. The steps of the method of the invention are as follows:

1. **Determine the number of tone levels required in a pixel.** A continuous tone image pixel requires 256 graylevels to provide an accurate representation, however, a halftone image pixel does not require the full 256 graylevels. If, however, there are not enough graylevels, the original halftone dots will not be accurately reproduced.

2. **Select a halftone cell size.** For example, for 4-bit halftoning, each pixel may display 15 levels of gray; therefore, an NxN sized halftone cell is able to display K amount of graylevels, where K = N x N x 15. For good printing quality, a halftone dot should be able to

display 255 graylevels, at least be able to display a number of graylevels close to 255. The original dot density is preserved by applying a multi-step threshold during scanning.

3. **Arrange the dot growth pattern.** If the dot growth pattern begins in the center of the halftone cell, a screen pattern will be visible. If any periodic dot centers can be visually sensed, the screen pattern will also be visible. The method of the invention provides a technique for avoiding the dot centers by growing the halftone dots evenly over the entire halftone cell. "Evenly" means that, in a tint area for any input graylevel, the maximum sub-pixel level difference among all pixels is "1".

The method of the invention uses a very fine grid, which is a repeatable pattern, which follows the original halftone structure. The input signal is used with several levels of thresholding, *i.e.*, the halftoned image is descreened using multilevel thresholding, however, because no secondary pattern is applied to the original signal, no moiré is produced.

The Applied Art

U. S. Patent No. 6,172,769 B1 to Rao *et al.*, describes a descreen process, which, as described above, and in the Background portion of the Specification, is an averaging process, which results in distortion to the second generation halftone. The reference is a single-level process. A secondary signal is applied to the original signal, which results in the objectionable moiré.

U. S. Patent No. 5,777,757 to Karlsson *et al.* describes a multi-level process, however, the process generates a halftone from the original image.

The Examiner proposed combination of Rao *et al.* and Karlsson *et al.* does not suggest the method of the invention because a halftoned image, once descreened by the method of

Rao *et al.* requires more treatment before the application of Karlsson *et al's* method, otherwise, the moiré will appear.

The Claims

Claim 1 has been amended to incorporate the limitations of:

...scanning the selected halftoned image to produce a second generation halftoned image;

reproducing, for each pixel in the second generation halftoned image, a pixel tone level;

selecting, from the set of tone levels, a tone level closest to the pixel tone level of each pixel in the second generation halftoned image to minimize noise generated during scanning without constructing a new halftone center;

arranging a dot growth pattern evenly across the second generation image.

These limitation are described in the Specification beginning on page 7 at line 22, and continuing through page 10, line 2. As previously noted, the applied art averages the halftoned image, which results in blurring and the generation of moiré. The method of the invention averages the noise created during scanning, which retains the original characteristics of the halftoned image, and does not produce moiré.

Roa *et al.* describe a conventional descreening process, which will result in the generation of moiré. '769 does, however, describe the selection of an image, as does '757. Whether '769 describes determination of the *number* of tone levels is subject to interpretation: the applied portion describes identifying bits, and associating the bits with a gray level. there is no mention of determining the actual number of tone levels required for each pixel of the halftoned image.

The application of Karlsson *et al.* as teaching "...offset initial dot growth from the center of the halftone cell...." is not supported by the applied portions of the reference. Figs. 5-7

of '757 clearly show that initial dot growth begins at the edge of a halftone cell, not in the center. Compare '757 Figs. 5-7 with Applicant's Fig. 11. In light of the foregoing, claim 1 is allowable over the prior art of record.

Claims 2-5 are allowable with their allowable parent claim(s).

Claim 6 recites that number of tone levels is fifteen plus white. The reasons for this is found in the Specification, page 9, line 21 to page 10, line 2, because this is the maximum number of tone levels perceptible by the HVS. the applied portion of '769 uses the formula $k/2^B$, where k is the maximum possible gray level and B is the number of bits chosen. The Examiner is correct that if B = 4, 2^4= 16, however, this has nothing to do with selecting the maximum number of tone levels to be fifteen levels of gray plus white based on the HVS: if $B \neq 4$, some other number of tone levels will be used, and '769 is silent as to how B is selected, and states that B may be 4 to 12, col. 2, lines 37-38. Claim 6 is therefor allowable over the applied art, because the applied art does not teach or suggest specifically setting the number of tone levels to fifteen levels of gray plus white.

Claim 7 is allowable with its allowable parent claim.

Claim 8 is allowable for the reasons set forth in connection with claim 1, and because the limitation of preserving the original dot amplitude has been added, as described in the Specification, page 8, lines 2-10. As noted in the discussion of the invention and the applied art, where the halftoned image is descreened, the original dot density, treated an a signal amplitude, is not preserved. Applicant's method of the invention, using multi-step threshold reading of the original image allows the original dot amplitude to be preserved. This is neither taught nor suggest by either applied reference, not by a combination thereof: '769 does not use a multi-step

process; '757 uses a multi-step process which averages the density in a sub-cell. Claim 8 is allowable over the prior art of record.

Claim 9 is allowable for the reasons set forth in connection with claim 6.

Claims 10-12 are allowable with their allowable parent claim(s).

In light of the foregoing amendment and remarks, the Examiner is respectfully requested to reconsider the rejections and objections stated in the Office action, and pass the application to allowance. If the Examiner has any questions regarding the amendment or remarks, the Examiner is invited to contact the undersigned.

Provisional Request for Extension of time in Which to Respond

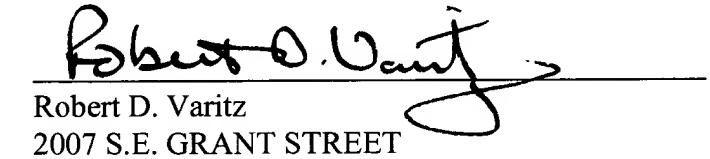
Should this response be deemed to be untimely, Applicants hereby request an extension of time under 37 C.F.R. § 1.136. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any over-payment to Account No. 22-0258.

Customer Number

23855

Respectfully Submitted,

ROBERT D. VARITZ, P.C.



Registration No: 31436
Telephone: 503-720-1983
Facsimile: 503-233-7730

Robert D. Varitz
2007 S.E. GRANT STREET
Portland, Oregon 97214